Effect of plyometric and weight training program on selected physiological and physical variables on school going students.

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Chapter 1

INTRODUCTION

Forces generated by the body's voluntary muscles operating through the skeleton's lever systems enable physical activity and athletic performance. Unfortunately, the description and measurement of athletic and exercise performance in people have been played using a range of words and measuring systems across time. Movement can be defined as a series of repeated muscular contractions regulated by neural control mechanisms that are directed by motor learning pathways. Purposeful movement is dependent upon the intimate communication of each and every muscular length and tension regulating mechanism. In athletics, success is dependent upon the speed at which these impulses are transmitted and the subsequent muscular force that is achieved. The term used to define this equation is power or work divided by time (Work/Time). Humans have always been competitive; it goes back to their very beginnings. In recent years, competitive sports have grown quite quickly all around the world. Going beyond what were formerly perceived as restrictions is one of life's most thrilling and gratifying experiences. due to cutting-edge, organized, scientific, and ongoing research in the realm of physical education and sports. Sportspeople have started breaking records in every sport that was once thought to be impossible. The greater degree of performance in sports skill has been linked to scientific training techniques and the use of fundamental body mechanics concepts. Performance is the end product of a multitude of coordinated efforts and functional integrations. Probably a significant part of an individual's performance capacity is genetic. It seems that a person's genetic makeup accounts for up to 70% of their maximum force, strength, or ability. Both the physical environment and the location have an impact on performance. Additionally, to a certain extent, performance is influenced by physical and motor fitness, both of which can be significantly improved with the right training.

Performance can only be significantly raised or improved by inducing biological adaptation, which can only be accomplished via methodical, scientific training. It is important to follow the overload principle and exercise specificity for improving the effectiveness of the body's numerous systems. There are several training methods in use to enhance each motor skill at different levels. According to Hooks, the secret to get succeed in sports and games is strength. The

concept that strength is important in sports is not new. Everyone who participates in sports has a significant need for a better knowledge of strength. Sports training is a fundamental step in preparing athletes for higher performance through physical activity. It is founded on scientific concepts and aims to improve performance and education. Sports activities include motor movement and activity, and how effectively they are carried out has a significant impact on their performance. A crucial part of the training process is the development of training technique and tactical efficiency. The key factors that affect an athlete's physical performance are strength, speed, agility, endurance, and power coordination skills. Natural talent determines action potential, but basics also serve as the cornerstone for excellence.

Plyometric, which derives from Latin, is translated as "measurable increases" in plyometrics. Plyometric exercises allow a muscle to attain its greatest strength in the shortest amount of time. Power is the term for this speed-strength ability. In an effort to enhance performance, coaches and athletes have been striving to boost power for many years. Exercises including hopping, bounding, and leaping have been employed in a variety of ways to improve athletic performance throughout this century and doubtless for a very long time before. Plyometrics is the name given recently to this remote form of training for power or explosiveness. To experience the potential benefits of plyometric exercise, the stretch-shortening cycle must be activated. This requires paying strict attention to the technique of the drill or exercise. The tempo of stretching rather than the amount of stretching is more important in plyometric training. The ground contact duration or coupling time must also be as brief as feasible. In competitive sports and games, strength in the form of explosive power is more frequently utilized. An athlete's capacity to create force quickly will be a key factor in determining whether he succeeds in any situation where he must accelerate either himself, an external object, or both. Speed and strength are essential elements of fitness that may be seen in variable degrees in almost all sports activities. Simply explained, power is the result of combining strength and speed. With its requirement for intense and quick force generation, power is the one aspect of an athlete's fitness that may be the most predictive of success in sports. The capacity of the Nero muscle systems to generate the largest feasible impulse in a specific amount of time is referred to as power. The length of time relies on the amount of load or resistance the athlete must overcome as well as how the acceleration is organized. Power and strength have a hierarchical connection with one another;

they are not separate concepts. The fundamental characteristic that affects power performance is maximum strength.

The current popular weight training ideology is based on the historical training methods used by weight lifters, body builders, and athletes. Generation to generation transmits training knowledge. High school coaches frequently employ college coaches' programme, which imitate those used by professional athletes. Professional athletes are frequently able to recover from cryogenic therapy in addition to being able to handle higher volumes and intensities of labor. The previous programme frequently resulted in physical and psychological overtraining without this cryogenic assistance. Natural training differs greatly from artificial training. Programme principles from the "70s and 80s" were incorporated by many coaches, players, and other people. Weight training has become universally acknowledged as the best means of increasing strength. But present-day sportsmen and sportswomen have not simply adopted the lifting schedules of the weight-lifters and body builders. The reason for this is obvious; not '^ Mc. Ardle William, "Exercise Physiology", Philadelphia, London 1991. 13 only are the requirements in each sport different, each sport different, everyone’s strength increase requirements differ. That is why, Coaches and sportsmen should plan individual schedules designed to improve strength in particular muscle groups, where there is a weakness, as well as schedules to improve the individual all-round strength.

STATEMENT OF PROBLEM

Effect of plyometric and weight training program on those physiological as well as physical variables on school going students.

SIGNIFICANCE OF THE STUDY

The present study may be of significance in the following ways

- The study may reveal many important facts regarding the comparison between plyometric and weight training on a few physiological factors in school pupils.

- The study may also help the individuals to be informed of various effects of plyometric and weight training exercises for enhancing cardiovascular endurance.

- The current study will aid in the formulation of training physiological variables for school pupils in those regions that are recognized as their subject's weak points, using various plyometric training methods.

- To provide schoolchildren a training programme that is efficient and focuses on the development of their maximum cardiovascular endurance.

- It may outline the definitions of plyometric and weight training while also highlighting their connections.

OBJECTIVES OF THE STUDY

1) To evaluate the physical compentancy of the training programme before and after the test in the chosen groups.
2) To examine the physical performance of Group-A's plyometric training programme before and after testing.
3) To investigate the physical performance of Group-B's weight training throughout the pre- and post-test.
4) To examine the physical performance of Group C, the control group, before and after the test without any sort of training.
5) To investigate the correlation between the respondents' pre- and post-test weight-training regimens and plyometric training.
6) To look into how training has affected the research groups.

HYPOTHESIS

The following hypotheses were developed considering the literature review, current research findings, expert advice, and scholars' personal knowledge of the issue:

- The physiological characteristics of school-going children' responses to weight training and plyometric exercise are predicted to differ significantly.

- It is hypothesized that students who participate in plyometric and weight training would have significantly different vital capacities.

- It is hypothesized that students participating in plyometric and weight training programmes would have significantly different resting heart rates.

- It is hypothesized that students who participate in plyometric and weight circuit training programmes would have significantly different levels of cardiovascular endurance.

- The blood pressure of students participating in plyometric and weight training programmes is hypothesized to change significantly.

- It is hypothesized that students participating in plyometric and weight training programmes would have significantly different vertical jumps.

- It is hypothesized that students participating in plyometric and weight training programmes would have significantly different back and leg strength.

DELIMITATIONS

1) The study will be restricted to 60 school going students of J.N.V Ganderbal J&K
2) The individuals will be between the ages of 14 and 18.
3) The training period will be limited to 12 weeks.
4) The study will be delimited to only male participants.
5) The study will be delimited to the following dependent variables:

a: vertical jump e: resting heart rate

b: back strength f: anaerobic power

c: horizontal jump g: blood pressure

d: leg strength

LIMITATIONS

1) The study's limitations may include the individuals' individual behaviours, mental health, emotional stress, and other uncontrollable factors that may have an impact on the findings.
2) Any biases that could develop as a result of dishonest replies from the participant may be viewed as a research constraint.

DEFINITIONS AND EXPLANATION OF THE TERMS

- TRAINING

  Training may be defined as "systematic process of repetitive, progressive exercise or work, involving the learning process and acclimatization".

- PLYOMETRIC TRAINING

  Plyometric exercises allow a muscle to attain its maximum strength as quickly as feasible. The training programme which includes plyometric exercise such as double leg jumps, hopping, squat jumps, counter movement jumps and depth jumps is considered as plyometric training

- WEIGHT TRAINING

  A type of resistance exercise that involves the use of free weights or a weight lifting machine.

- STRENGTH

  Strength is the capacity to act against or overcome resistance.

- POWER

  When stated using the formula, power may be thought of as the rate at which work is performed as a function of force and velocity. Power is defined as force multiplied by velocity, or work done divided by time. The ability to activate maximal muscular contraction at a rapid pace or speed is another definition of power.

- LEG STRENGTH

  Leg strength refers to the lower limb's ability to generate muscular force.

- RESTING HEART RATE

  A person's carotid or radial arteries may feel how many heartbeats per minute while they are at rest.

- ANAEROBIC POWER

The quantity of work carried out largely by anaerobic energy sources is known as anaerobic power.

Chapter II

REVIEW OF RELATED LITERATURE

Wilson, Murphy & Giorgi (1996) The goal of the research was to get an in-depth understanding of the changes induced with plyometrics and strength training. Forty-one past trained guys were divided into three groups at random: control, plyometric, and weight training. The experimental groups engaged in either heavy lifting or dynamic plyometric workouts during their 8-week training period. Training with plyometrics considerably increased the eccentric lower body force's rate of production. The strength training group improved concentric functions predominantly. These findings are examined regarding techniques for boosting training related adaptations and the kinds of mobility such training would typically likely to encourage. These findings were ascribed to the unique pressures imposed by the various forms of training.

Avery D. Faigenbaum (2007) The vision of the study went through the comparison between effects of a six-week training session using the resistance training alone, combined effects of resistance and plyometric training on male athletes' fitness levels. While the plyometric resistance training group completed plyometrics activities followed with the identical resistance training programme, the RT group engaged in static stretching exercises first. Each training session lasted 90 minutes for both groups. All individuals underwent testing at various physical tests at baseline and after training. Following training, the Plyometrics Resistance Training group substantially (p 0.05) improved more than the RT group. The results suggest that for improving specific measurements of boys' upper- and lower-body strength. Plyometric exercise may be more beneficial when incorporated into a resistance training routine.

A. Palanisamy (2019) The study's goal was to determine how Kabaddi players' plyometric training affected their physical characteristics. 30 kabaddi players from male category of Bharathidasan University in Tiruchirappalli, Tamil Nadu, ranging in age from 18 to 25, were chosen at random for the current study. In the current study, a randomised group design with a control group and an experimental group was adopted for the pretest and posttest phases. The individuals were split into two equal groups, each with fifteen people, designated as Groups "A" and "B,"

and they were chosen at random. Group 'A' received plyometric training, whereas Group 'B' received no training. Data was gathered both before to and following the six-week training session. The dependent 't' test was used to analyse the data and determine the impact of the plyometrics training regimen. The results of this study clearly suggest that plyometric training, which lasts for six weeks, has a major impact on the players' explosive strength, muscular endurance, and speed. Therefore, the earlier-set hypothesis that plyometric training would have a significant impact on a few physical variables is accepted considering the same. Plyometric exercise has a significant impact on explosive strength, muscular endurance, and speed.

Blakey and Southard, (1987) In this study, plyometrics exercise (depth drops) and weight training were coupled to examine the effects on the dynamic strength and power of the legs. Plyometric workouts require the muscle to rapidly stretch before contracting in order to produce more force throughout contraction. Subjects in each group were divided into two categories: low (less than 2) and high (more than 2). Tests of anaerobic power and dynamic leg strength were administered to each group before and after for a period of eight-week plyometric and weight training conducted. Leg-strength and Magaria power ratings did not differ significantly between groups, conditions, or their interactions. Significant improvements were seen for each group when tests were performed. Additionally, it should be noted by coaches and athletes that nor the strength level even nor the height of the drop factors changed the training benefits of the combination programme utilized in the study.

Gregory C Bogdanis et.al (2019) studied Comparison of the effects of unilateral as well as bilateral plyometric training on the strength & efficiency of single- and double-leg leaping. In this investigation, the effects of unilateral as well as bilateral plyometric training were evaluated in terms of their impacts on rate of forceful development (RFD), maximum strength, and single- and double-

leg leaping performance. Unilateral or bilateral groups were randomly allocated to 15 moderately trained volunteers. For six weeks, both teams engaged in two sets of plyometric leg exercises with maximum effort. The overall volume of exercise was the same for both groups, the Unilateral group only did half of the repetitions of each exercise with each leg. Improvement in countermovement jumps with both legs between the Unilateral and Bilateral groups was not statistically different. However, in the U group as comparatively to the B group, the total of those right and left leg maximum forces rose greater. Like this, only the U group had an improvement in the total of the right and left leg. Comparing with bilateral training, unilateral plyometric training found to be enhanced.

Lunxin Chen et. al. (2023) Training using plyometrics is a good way to develop explosive strength. Despite the lack of significant meta-analyses on the impacts of plyometrics training to the lower limb's explosive strength among teenage athletes, the capacity to do plyometric training among the adolescent's population is at present debatable. The goal is to find out how plyometrics exercise affects young athletes' lower-limb explosive strength. In summary, plyometricexercise can greatly improve teenage athletes' lower limb explosive strength.

Govindasamy Karuppasamy (2018) The goal of the study was to determine how certain physical and physiological factors in male volleyball players responded to plyometric training and circuit training. 24 male volleyball players between the ages of 18 and 25 were chosen at random. Two groups—one control was one group and the experimental was one group—were formed, and experimental group I had six weeks of plyometric training while experimental group II underwent six weeks of circuit training. The control group wasn't allowed to participate in any training initiatives. Prior to the experimental treatment, a pretest was done to measure dependent variables followed by a posttest was then administered. The dependent 't' test and ANCOVA were used to analyze the data. According to the findings, plyometric and circuit training dramatically increased some selected components.

Gehri, D. J. et. al. (1998) The ultimate aim of this study was identified the most effective plyometric training method for enhancing elastic energy generation, vertical leaping ability, and positive energy production. ANOVA was used to analyse the data that were gathered before and after a 12-week jump training programme. Squat leap, countermovement jump, and depth jump tests were conducted on subjects (N = 28), who were then randomly allotted to each of three groups: depth jump training or countermovement jump training. For all training groups, the 12-week programme led to a noticeable improvement of vertical jump height. In all 3 leaps, the depth jump group considerably increasing their vertical jump height. None of the training techniques increased the efficiency of using elastic energy. Due to its neuromuscular specificity, drop jump training outperformed countermovement jump training in tasks involving dynamic stretch-shorten cycles. This study supports the decision to incorporate plyometrics deep jumping training into the athlete's overall training regimen in order to enhance concentric contractile performance and vertical leaping ability.

Chapter III

METHODOLOGY

This chapter explains the steps taken in the subject selection, variable selection, test selection, test administration, and statistical techniques.

SELECTION OF SUBJECTS

Only sixty enrolled students would be chosen at random as subjects. Three category groups of twenty per group will form the chosen subjects. Over the course of twelve weeks, Group I will went through plyometric training and Group II will went through weight training. Group III served as the control group and only engaged in their daily activities as exercise. The individuals were between the ages of 14 and 18.

SELECTION OF VARIABLES

a. Dependent Variables: Speed and strength are essential characteristics in all sports. In most cases, it necessitates improving performance in sports and games. In sports, speed is a magical force. A better athlete and more competition winners are likely to be those who can throw and run quicker. Power is a crucial attribute in many sports because it embodies the efficient fusion of strength and speed. Power increases when strength or speed are increased because more work may be completed in a shorter amount of time. One of the most crucial elements that influence an individual's performance level is their physiological characteristics. The athletes' psychological health and physical fitness level have a significant impact on how well they perform in sports. Sports are physical activities that cannot be done without certain skills. The most crucial elements for predicting sports performance are fitness-related. Fundamentals are the cornerstones of excellence, while natural talent holds the promise of possibility. Consequently, the variables listed below would be chosen for this study.

(a) Physical Variables

Vertical jump

Leg strength

Back strength

Horizontal jump

(b) Physiological Variables

Resting heart rate

Anaerobic power

Blood pressure

(c) Independent Variables

Anatomical, physiological, biomechanical, and psychological changes result from every physical exercise. The idea of plyometrics is old concept. Its been long been used to raise performances. It has just recently attracted a lot of attention. Since the 1960s, the term "plyometrics" has been in usage. Plyometric training is based on the idea that performance may be improved by utilizing movements that are similar to those that would be used in a certain sport or activity. Plyometric exercises and weight training together have been shown in several studies to be much more effectively in increasing physical component. So, the researchers will look into what impact following trainings have on volleyball players.

1. Plyometric training
2. Weight training

SELECTION OF TESTS

The tests that would be utilized to gather pertinent information on the chosen dependent variables were listed in table I in accordance with the literature that is currently accessible.

TABLE I

TESTS SELECTION

S. NO	Criterion Variable	Name of the Test
1.	VERTICAL JUMP	SERGANT JUMP

2.	HORIZONTAL JUMP	STANDING BROAD JUMP
3.	LEG STRENGTH	WALL SQUAT TEST
4.	BACK STRENGTH	KRAUS WEBER TEST
5.	ANAEROBIC POWER	300 YARD SHUTTLE TEST
6.	RESTING HEART RATE	RADIAL PULSE METER or BY MANUALLY
7.	BLOOD PRESSURE	SPHYNOMANOMETER

ADMINISTRATION OF TESTS

1. Explosive Power (Vertical Jump)

Purpose: Measure the vertical explosive strength using this device.

Equipment: The data will be collected using a plywood board, as described by Sargent.

Procedure: The students will do the Sargent leap test to measure their vertical leap. Subjects will be instructed to practise for a short while before the vertical jump test is conducted. A plywood panel with a 1 cm. 50 cm wide) will be utilised, with lines drawn horizontally at intervals of 1 cm. The subject will stand with his back to the wall and raise his heels as high as he can before making a mark with his fingers on the wall. The individual then assumes a crouching stance with his legs bent roughly at a straight angle and swings his arms downward and backward. After reaching the greatest point of the leap, the subject will jump as high as they can while swinging their arms upward, leaving a new mark above the first. There will be a one-minute break in between each of the three trials.

Scoring: Between the reach and leap marks, the score will be calculated and recorded to the closest centimetre. The test result will be the highest of the three tries.

2. Standing broad jump

Purpose: To measure the explosive power of the legs.

Equipment: It is advised to have a tape measure to record the height of the jump

Procedure: Standing behind a line that has been painted on the ground, the athlete should space their feet slightly apart. They will lift off and land on two feet, swinging our arms and bending our knees to propel ourselves forward. In order to avoid rolling backward, the participant aims to jump as high as they can. Three tries would be permitted.

Score: The distance from the starting line to the point of closest contact on the landing (the back of the heels) will be measured. The best of the three jumps with the greatest distance will be recorded.

3. Wall squat test (leg strength)

A straightforward test of lower body physical strength and endurance is the wall squat. The individual must maintain a sitting position while leaning back against a wall for the duration of the exam.

The goal is to gauge your lower body's strength and endurance, especially your glutes, hamstrings, and quadriceps.

Equipment includes a timer, a smooth wall, and a flat, non-slip floor.

Steps to follow: Stand comfortably with your feet approximately 2 feet from the wall and your back against a straight, smooth wall. So that your knees and hips are situated at a 90-degree angle, slide your back down the wall. Adjust the feet's distance from the wall if necessary. Make sure the feet are flat on the ground, the knees are at right angles to the hips, and the back is level against the wall. Knees should be directly above your ankles, not over your toes.

Your thighs and ankles should be parallel to the ground. Timing starts as soon as the proper posture is adopted and ends when the subject is unable to maintain it.

Calculate your score by adding up the number of seconds that each position was held.

4. Upper Back Muscle Strength (Kraus-Weber Test)

The upper back muscles' strength is measured with this test of back muscular power. The test is a component of the Kraus-Weber fitness test protocols, a set of six medical fitness tests designed to assess the flexibility and strength of the body's major postural (core) muscles.

Purpose: To assess the strength of the upper back muscles.

Equipment: Flat surface, pillow, stopwatch

Procedure: The individual will be lying face down on his stomach in the "prone" posture, with his hands behind his neck and a cushion beneath his lower belly. In contrast to the other Kraus Webber back strength test, when the chest is pulled down, the examiner will keep his feet planted. The examiner will instruct the individual to elevate his shoulders, head and chest while counting to ten seconds. If he can maintain the exact posture for 10 seconds, he passes this test.

Scoring: The test has a pass/fail grading system. If the patient maintains the stance for 10 seconds, the test is considered successful. There are 6 exercises in the Kraus-Weber test: failing to complete any one of the six exercises constitutes failure.

5. Resting Heart Rate

Purpose: To tally the minutes of resting heart rate.

Equipment: Stop watch and chair will be used.

Procedure: All subjects' pulse rates will be taken in the morning session between 6 and 7 am while they are sitting still. Prior to the pulse reading, the subjects will be asked to relax for 15 minutes. The left radial artery at the wrist or the tips of the three fingers should be positioned so that the

pulse will be evident when the pulse rate is being recorded. The number of pulses will be recorded for 15 seconds, then multiplied by four to record for one minute.

6. 300 Yard Shuttle Test (12 x 25 yards) anaerobic power

The 300 Yard Shuttle Test measures anaerobic endurance by having subjects sprint 25 yards, turn around, and repeat for 12 times for a total of 300 yards.

Purpose: It measures anaerobic endurance.

Equipment: a level area of grass, a timer, a measuring tape, and marker cones

Procedure: To denote the sprint distance, 25-yard marker cones and lines will be put in place. Put one foot on one line to begin. The player sprints to the opposing 25-yard line, touches it with their foot, turns and runs back to the starting line as directed by the timer. Without pausing, this is performed six times, totaling 300 yards. The exam is repeated after a five-minute break.

Scoring: Record the average of the two 300-yard shuttles.

7. Blood pressure test

Measuring blood pressure is crucial since it is closely linked to the risk of developing heart disease.

Equipment: Mercury sphygmomanometer, cuff, stethoscope.

Procedure: The subject will not be able to view the mercury column in the sphygmomanometer since it will be positioned on a bench. After the subject has slept soundly for five minutes, the blood pressure will be taken. This test should come first, before any others. The individual will be seated with one arm on the bench and the other elbow about at heart level. After the cuff is fastened, the pressure will be raised to about 180 mm Hg. The brachial artery in the cubital fossa will be covered by the stethoscope. A 2 mm per second release of pressure is what may be expected. Systolic pressure and diastolic pressure, respectively, will be measured. Systolic pressure is the pressure at which the initial noises would be audible.

Measurement: The measurement of blood pressure is done in millimetres of mercury (mm Hg). For both men and women, 120 systolic and 80 diastolic is generally regarded as the normal blood pressure range. If measures are routinely in the high group, medical attention should be sought.

	Acceptable	**Borderline**	**High**
Systolic	< 140	140 - 160	> 160
Diastolic	< 85	85 - 95	> 95

STATISTICAL PROCEDURE

To determine any significant differences on any of the groups for each variable independently, Analysis of Covariance (ANCOVA) will be utilized. Using the computer's statistical software (SPSS), all the data will be examined.

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